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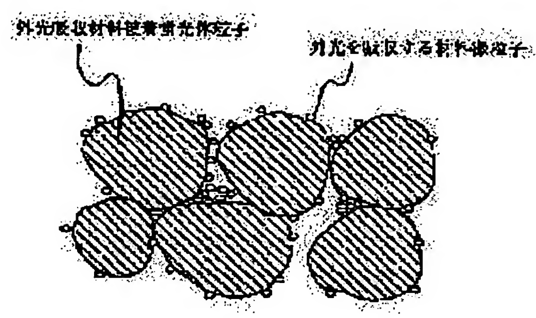
(54) FLUORESCENT LAYER AND DISPLAY DEVICE HAVING THE LAYER

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a fluorescent layer capable of absorbing light excluding the wavelength range of the light emitted by the fluorescent material and developing high contrast and useful for a plasma display, etc., by using a specific light-emitting particle in combination with a specific light-absorbing material.
SOLUTION: This fluorescent layer contains (A) a fluorescent particle emitting visible light by the excitation with ultraviolet rays having a wavelength of 200 nm and (B) a material having a light-absorbing power in a wavelength range other than the wavelength of the visible light emitted by the component A (e.g. Fe_2O_3 absorbing green and blue light, ZnO/TiO_2/NiO/CoO absorbing red and blue light or CoO/Al_2O_3 absorbing red and green light). The fluorescent layer preferably contains 5 wt.% of the component B based on the component A. The fluorescent layer is formed in a state containing the fine particles of the component B attached to the surface of the component A or mixed in the space between the particles of the component A e.g. by mixing the component A, the component B and a vehicle to obtain a paste, applying the paste to a desired part by screen printing and drying and baking the applied paste.



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* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]
[The technical field to which invention belongs] this invention relates to the display equipped with the fluorescent substance layer excited by rare-gas resonance ultraviolet rays (the so-called vacuum ultraviolet radiation) with a wavelength of 200nm or less and its fluorescent substance layer, such as flat-surface type plasma display and rare-gas electric discharge ********.

[0002]
[Description of the Prior Art] A plasma display is a method which carries out a color display by making the fluorescent substance which made the short wavelength ultraviolet rays (the resonance line is in 147nm or 172nm when a xenon is used as rare gas) generated in the negative ** ** row field in the minute electric discharge space containing the rare gas in the display panel the source of excitation, and has been arranged in electric discharge space emit light. The structure of this discharge-in-gases cell is ******** indicated by for example, "color PDP technique and a material" / CM **** Issue], and shows typical structure in drawings 3 and 4.

[0003] In the display panel of a plasma display, the short wavelength limitation is 58.4nm of the resonance lines of helium, using the resonance line of the rare gas with wavelength shorter than 253.7nm of the mercury steamy resonance lines etc. as a source of excitation of a fluorescent substance. Display-panel cross-section structural drawing of drawing 3 shows the structure of the display panel of a general field electric discharge type color plasma display. The front substrate glass and tooth-back substrate glass which were able to be done by the glass substrate are stuck, and it unifies, and this view shows the cross-section structure of the fraction corresponding to 1 pixel, and shows the reflected type display panel which formed the fluorescent substance layer in the tooth-back substrate side. The front substrate consists of a display electrode of a couple which separated a fixed distance and was formed in parallel on the confrontation side with a tooth-back substrate, and a dielectric layer for AC drive on it. The electrode group which a tooth-back substrate becomes from the address electrode which intersects perpendicularly on the confrontation side with a front substrate at the display electrode group of a front substrate, The septum which consists of a low melting glass which divides between address electrodes in order to prevent the flare of electric discharge (the field of electric discharge is specified) (rib), It consists of each fluorescent substance layer which emits light in the red (R) and green (G) which were kicked by ** in the shape of a stripe in order in the type which covers **** between this rib, and blue (B). After mixing fluorescent substance grain and a vehicle, considering as a fluorescent substance paste and forming an address electrode and a septum in a tooth-back substrate, this fluorescent substance layer is formed by technique, such as screen-stencil, makes baking remove a volatile component and is formed.

[0004] The fluorescent substance layer of the field is excited by the vacuum ultraviolet radiation produced by the discharge in gases of the unit photogenesis field (electric discharge spot) which the discharge gas (mixed gas, such as neon and a xenon) not to illustrate is enclosed with the electric discharge space between a front substrate and a tooth-back substrate, discharges between the display electrodes containing X and Y sus ****** electrode, and is chosen by the address electrode, and visible photogenesis is obtained. And the color display has been obtained in the combination of the amount of photogenesis of the unit photogenesis field which has the red corresponding to the three primary colors, green, and a blue fluorescent substance layer.

[0005]
[Problem(s) to be Solved by the Invention] Although the brightness of the display-panel division color panel of a plasma display is improving every year now (-450 cd/m2), as compared with it (peak brightness 600-1000 cd/m2) of direct-viewing-type electron tube color TV, it is low and a property improvement of luminous efficiency etc. is desired. By this brightness, display contrast in the light field which influence a picture image quality cannot fully be acquired, but the

development of the contrast improving method do not affect a brightness property is desired strongly. Especially in the field in which display-panel resolution exceeds VGA, since a cell size reduction-izes and display-panel luminous efficiency falls, a fall of brightness arises and a contrast fall poses a big problem.
[0006] The purpose of this invention is to offer display, such as a plasma display equipped with the fluorescent substance layer which can acquire high contrast, and the display panel using this fluorescent substance layer.
[0007]
[Means for Solving the Problem] The fluorescent substance layer containing the fluorescent substance grain which emits the light by excitation of ultraviolet rays with a wavelength of 200nm or less, and the material which has an optical absorption to wavelength fields other than the wavelength of this light can attain the above-mentioned purpose.
[0008]
[Embodiments of the Invention] Specifically, an optical-absorption material adds or mixes the material which has an optical absorption to a green and blue wavelength field in a red photogenesis fluorescent substance layer. In a green photogenesis fluorescent substance layer, the material which has an optical absorption to red and a blue wavelength field is added or mixed. In a blue photogenesis fluorescent substance layer, the material which has an optical absorption to red and a green wavelength field is added or mixed. By these configurations, a fluorescent substance can absorb the light of other wavelength regions except for the wavelength field of the light emitted himself. Consequently, in the case of a reflected type display panel, the amount of reflected lights of outdoor daylight can be reduced, and when it is a penetrated type display panel, the amount of transmitted lights of outdoor daylight can be reduced.
[0009] Addition of the material which absorbs this outdoor daylight may prepare the paste which added the material which is made to cover directly not only to technique but to the fluorescent substance directly mixed during the paste which forms a fluorescent substance layer, or absorbs outdoor daylight apart from a fluorescent substance paste to it, and may produce a fluorescent substance layer.
[0010] Moreover, this fluorescent substance layer can take various structures by arranging the material which absorbs outdoor daylight in the suitable position in a fluorescent substance layer. When making the material which absorbs outdoor daylight put on the front face of the fluorescent substance grain in a fluorescent substance layer uniformly and it carries out mixed arrangement uniformly in a fluorescent substance layer, addition arrangement of the material which absorbs outdoor daylight further may be carried out by the suitable concentration for arbitrary fields. A contrast improvement can be performed by arranging by the suitable thickness and suitable concentration for the substrate side by which especially vacuum ultraviolet radiation is not irradiated directly, without affecting the brightness life of a fluorescent substance layer.
[0011] For reducing absorption of vacuum ultraviolet radiation irrespective of in which position of a fluorescent substance layer the material which absorbs outdoor daylight is arranged It is effective to make particle size of the material which absorbs outdoor daylight into the wavelength size and EQC of vacuum ultraviolet radiation which are excitation light, or to make it smaller than the size. Vacuum-ultraviolet-radiation absorption with the material which absorbs outdoor daylight can be reduced by this, and photogenesis brightness can be maintained to the excitation quantity of light pan of a fluorescent substance. In this invention, four sorts, 30 to 500nm to 300nm larger than a wavelength size, 200nm to 150nm of an equivalent size, 100nm to 70nm of 1/2 size, and 10nm of 1/4 or less size, were prepared as a median particle diameter of the material which absorbs outdoor daylight. When the relation between these brightness and an outdoor daylight reflection factor was seen, it has checked that the method of the parvus had an effective median particle diameter. A median particle diameter measures the frequency distribution by the particle-size-distribution measuring device about the particle size (grain size) of fluorescent substance grain, and is taken as the particle size which is being weight criteria distributed and shows the median of a total grain weight.
[0012] Furthermore, the content to the fluorescent substance of the material which absorbs outdoor daylight is a parameter important for balancing the absorbed dose of vacuum ultraviolet radiation, and the absorbed dose of outdoor daylight, and it is necessary to optimize it. In this invention, the concentration of the material which absorbs the outdoor daylight to various fluorescent substances was optimized, and it turns out that brightness can maintain [the concentration] 60% or more (the brightness of a fluorescent substance layer in case the material which absorbs outdoor daylight is not included is made into 100%) less than [5wt%]. Moreover, reflection factors other than the wavelength region of the light emitted himself are reduced with the concentration, and it crawls on them at 5wt%, and they have obtained 40% or less of reflection

factors also in the material combination of ****. In this invention, the content from which a reduction of a real proof and photogenesis brightness can be suppressed for the relation between brightness and a reflection factor on a certain fixed level, and a reflection factor can acquire an effective value was found out.

[0013] Moreover, it is at this invention. It found out that it was effective in ZnO/TiO2/NiO/CoO, red, and a green wavelength field to use CoO / aluminum2O3 as a material which has an optical absorption as a material which has an optical absorption to Fe2O3, red, and a blue wavelength field as a material which has an optical absorption to a green and blue wavelength field. The amount of reflected lights or the amount of transmitted lights of outdoor daylight can be effectively reduced by a fluorescent substance absorbing the light of other wavelength regions except for the wavelength field of the light emitted himself by these materials. The concentration in these fluorescent substance layers found that there was reflection factor reduction effect with the content sufficient less than [5wt%] irrespective of the fluorescent substance kind to mix. However, in order to suppress a fall of brightness as much as possible, it is required to make the concentration still low, and it turns out that 90% of brightness is maintainable at 70% of brightness, and 1wt% at 2wt% with 80% of brightness, and 0.5wt%.

[0014] In case these fluorescent substance layers are applied to the display panel of the display which uses vacuum ultraviolet radiation for the source of excitation, especially a plasma display, it is important to form a fluorescent substance layer in consideration of the above-mentioned addition method, particle size, and concentration irrespective of the combination with the material which absorbs which fluorescent substance kind and outdoor daylight. Moreover, in case the fluorescent substance layer of this invention is applied to the display panel of a plasma display etc., when applying to the combination of a suitable two sort fluorescent substance layer it not only applying red and a green and blue light to the fluorescent substance layer emitted to each simultaneously altogether, but, or even when applying to one sort of arbitrary fluorescent substance layers, the contrast improvement effect by a reflection factor reduction or permeability reduction of outdoor daylight can be acquired. In connection with especially highly-minute-izing of the display panel of a plasma display, the improvement of contrast is important. Then, contrast is easily improvable by applying the fluorescent substance layer of this invention to the display panel of the plasma display with various septum spacings. The fluorescent screen for a contrast improvement of this invention is not caught by the combination of the fluorescent substance kind shown in the example, and the charge of an outdoor daylight absorber, but it can be used together with the method [improve / contrast] for preparing the conventional dimming VCF in the front face of display-panel glass etc. while it is applicable to various material combination. Such a simple combination of the contrast improving method is applicable to the display panel of the plasma display which can realize a big screen. Moreover, by applying the fluorescent substance layer of this invention to the display panel of the high definition plasma display whose septum spacing formed in a display panel is 200 micrometers or less, a fall of brightness can be suppressed to minimum and contrast can be improved.

[0015] Hereafter, an example explains in detail.

[0016] The configuration between the septum pairs of one substrate of a display panel (200 micrometers or less) is shown in sectional drawing example 1 view 1 . A median particle diameter consists of fluorescent substance grain 10 micrometers or less, and covering mixture of the outdoor daylight absorber of a particle is carried out in the front face or grain clearance of fluorescent substance grain as the fluorescent substance layer of this invention is shown in drawing 2. Formation of a fluorescent substance layer is performed after forming an address electrode and a septum in a tooth-back substrate. After mixing the fluorescent substance grain 40 weight section and the vehicle 60 weight section, considering as a fluorescent substance paste and applying by screen-stencil, xeransis and a baking process perform vaporization of the volatile component in a paste, and combustion elimination of the organic substance, and a fluorescent substance layer is formed.

[0017] In this example, the following materials were used as a material which has an optical absorption in arbitrary wavelength fields. The actually used material system the iron-oxide system material (Fe2O3) which has absorption strong against blue and a green field in a red fluorescent substance layer The cobalt-green system material (ZnO/TiO2/NiO/CoO) which has absorption strong against blue and a red field in a green fluorescent substance layer by the cobalt blue system (CoO / aluminum2O3) which has absorption strong against green and a red field in a blue fluorescent substance layer Each median particle diameter prepared the particle 50nm or less (10 to 30nm) which becomes about 1 of the vacuum ultraviolet radiation (147nm and 172nm) of short wavelength / four waves from 200nm which is excitation light. To fluorescent substance grain, the balance division, and the fluorescent substance mixture and the vehicle which mixed this optical-

absorption material further were prepared 40:60, mixed churning of the charge particle of these outdoor daylight absorber was fully carried out at 0.5wt%, a suitable weight ratio and here, the optical-absorption material entering fluorescent substance paste was prepared, and the fluorescent substance layer was produced in the above-mentioned procedure. Moreover, each fluorescent substance material used by this example is as follows. A red fluorescent substance is BO(Y, Gd) 3:Eu, a green fluorescent substance is Zn2SiO4:Mn, and a blue fluorescent substance is BaMgAl10O14:Eu. The display panel of the plasma display which formed the fluorescent substance layer on the tooth-back substrate, stuck the front substrate and the tooth-back substrate in the same procedure as the former, and enclosed the doubling discharge gas in such fluorescent substance composition and the combination of the charge of an outdoor daylight absorber was produced.

[0018] In example 2 this example, except having used the particle 100nm or less (70 to 100nm) which becomes about 1 of the vacuum ultraviolet radiation (147nm and 172nm) of short wavelength / two waves from 200nm which is excitation light about each median particle diameter of three sorts of charges of an outdoor daylight absorber to use, the fluorescent substance layer was formed in the conventional technique and the procedure like the example 1, and the display panel of a plasma display was produced.

[0019] In example 3 this example, except having used the particle 200nm or less (150 to 200nm) equivalent to the wavelength size of the vacuum ultraviolet radiation (147nm and 172nm) which is excitation light about each median particle diameter of three sorts of charges of an outdoor daylight absorber to use, the fluorescent substance layer was formed in the conventional technique and the procedure like the example 1, and the display panel of a plasma display was produced.

[0020] In example 4 this example, except having used the particle 500nm or less (300 to 500nm) which is a grain size larger than the wavelength size of the about 200nm vacuum ultraviolet radiation (147nm and 172nm) which is excitation light about each median particle diameter of three sorts of charges of an outdoor daylight absorber to use, the fluorescent substance layer was formed in the conventional technique and the procedure like the example 1, and the display panel of a plasma display was produced.

[0021] In order to produce the fluorescent substance layer which does not mix the charge of an outdoor daylight absorber as the example 1 of a comparison, next an example of a comparison of the above-mentioned examples 1-4, the conventional fluorescent substance paste was prepared, the fluorescent substance layer was produced in the same procedure as an example 1, and the display panel of a plasma display was produced further.

[0022] Here, display-panel evaluation of each example was performed on the basis of the display-panel property of the example 1 of a comparison.

[0023] For the display panel of an example 2, the display panel of an example 3 was [the display panel of an example 1 / the display panel of an example 4 of the brightness of each display panel] 82% 85% 88% 92% to the display panel of the example 1 of a comparison. Next, the reflection factor in the fluorescent substance layer in each example was evaluated. In order that a reflection factor might avoid the influence of a septum etc., it applied the fluorescent substance layer of each color individually on the glass substrate the condition in the above-mentioned example, and prepared the part beam sample.

[0024] The reflection factor of these samples was measured and the average reflectance was computed. The average reflectance in the example 1 of a comparison was 75% in the example 4 73% in the example 3 70% by the example 2 at the example 1 67% 90%. Thus, the contrast improvement was realizable, while the particle diameter of ****** could also acquire comparatively good brightness and the reflection factor property and suppressed the reduction of brightness. However, a better property can be acquired by making it 1/2 of the vacuum-ultraviolet-radiation wavelength which is excitation light, 1/4, and a short particle size.

[0025] From the above display panel and the evaluation result of a fluorescent substance layer, the charge of an outdoor daylight absorber found that influence of as opposed to [median particle diameter / the] vacuum ultraviolet radiation in the method of the parvus tends to acquire the target effect few. This, Vacuum-ultraviolet-radiation absorption with the material which absorbs outdoor daylight can be reduced. It is considered because photogenesis brightness is maintainable to the excitation quantity of light pan in a fluorescent substance. Therefore, as for the particle size of the material which absorbs outdoor daylight, it is effective to make it the wavelength size and EQC of vacuum ultraviolet radiation which are excitation light, or to make it smaller than the size, and it is desirable.

[0026] By example 5 this example, vacuum ultraviolet radiation examined the charge of an outdoor daylight absorber about how to arrange by the suitable thickness and suitable concentration for the substrate side which is not irradiated directly. Each fluorescent substance

material used here is as follows. A red fluorescent substance is O(P (Y, Gd), V)4:Eu, a green fluorescent substance is BaAl12O19:Mn, and a blue fluorescent substance is BaMgAl10O14:Eu. In this example, two sorts of the 1wt% charge entering fluorescent substance paste of an outdoor daylight absorber and an additive-free fluorescent substance paste were prepared to fluorescent substance grain using the particle 50nm or less (10 to 30nm) which becomes about 1 of the vacuum ultraviolet radiation (147nm and 172nm) of short wavelength / four waves from 200nm which is excitation light about each median particle diameter of three sorts of charges of an outdoor daylight absorber to use. Other conditions followed the procedure of an example 1.
[0027] In order to arrange the charge of an outdoor daylight absorber to a tooth-back substrate side, 10 micrometers of fluorescent substance ****s were first formed in the conventional technique and the procedure on the tooth-back substrate with the 1wt% charge entering fluorescent substance paste of an outdoor daylight absorber, and 10 micrometers of additive-free fluorescent substance layers were further formed on the fluorescent substance layer like the point after xeransis using the additive-free fluorescent substance paste. The cross-section structure of this fluorescent substance layer is shown in drawing 5. There is no charge of an outdoor daylight absorber in the irradiation side of vacuum ultraviolet radiation. Next, the front substrate 1 and this tooth-back substrate 2 were stuck, the doubling discharge gas was enclosed, and the display panel of a plasma display was produced.
[0028] In order to produce the fluorescent substance layer which does not mix the charge of an outdoor daylight absorber as the example 2 of a comparison, next an example of a comparison of the above-mentioned example 5, the conventional fluorescent substance paste was prepared, the fluorescent substance layer was produced in the same procedure as an example 5 (it forms in 2 steps similarly), and the display panel of a plasma display was produced further.
[0029] Next, display-panel evaluation of an example 5 was performed on the basis of the display-panel property of the example 2 of a comparison. The display panel of an example 5 of the brightness of a display panel was 95% to the display panel of the example 2 of a comparison. Next, the reflection factor in a fluorescent substance layer was evaluated. Measurement of a reflection factor was performed by the same technique as the above. 90%, the average reflectance in an example 5 was 70%, and the average reflectance in the example 2 of a comparison could acquire comparatively good brightness and the reflection factor property, was able to suppress the reduction of brightness, and was able to realize the improvement of contrast. Moreover, also with the brightness life, the property almost equivalent to the example 2 of a comparison was realized.
[0030] From the above display panel and the evaluation result of a fluorescent substance layer, the property also with almost equivalent to the case where outdoor daylight absorber material has been arranged on the average also arranging the layer containing an outdoor daylight absorber to the tooth-back substrate side in a fluorescent substance layer was able to be acquired. The contrast improvement was able to be performed, without affecting the brightness life of a fluorescent substance layer especially. By this technique, the charge entering fluorescent substance layer of an outdoor daylight absorber can take various structures by choosing the arrangement position and addition concentration suitably.
[0031] The brightness in the examples 6-11 and an example of comparison 3 fluorescent-substance layer and the property of a reflection factor change a lot by the content of the material which absorbs the outdoor daylight to a fluorescent substance. This outdoor daylight absorber absorbs the vacuum ultraviolet radiation which is excitation light by adding an outdoor daylight absorber, and this is considered to be the causes with main affecting a brightness property. Then, the content of the material which absorbs outdoor daylight [as opposed to a fluorescent substance for fluorescent substance layer independent brightness (standard of the amount of excitation absorption of lights) and the property of a reflection factor (standard of the absorbed dose of outdoor daylight)] was made into the parameter, and was evaluated. The brightness property used the deuterium lamp as the light source, took out only vacuum-ultraviolet light with a wavelength of 200nm or less with the VCF, and it was made into excitation light and it measured it. Moreover, the reflection factor was measured with the spectrophotometer. In the examples 6-11 and the example 3 of a comparison, the concentration was optimized in the red fluorescent substance layer about the iron-oxide system material (Fe2O3) which carries out addition mixture and which has absorption strong against a green field as it is blue. The median particle diameter of an outdoor daylight absorber prepared 50nm or less (10 to 30nm) which becomes about 1 of the vacuum ultraviolet radiation (147nm and 172nm) of short wavelength / four waves from 200nm which is excitation light. Here, BO3:Eu was used for the red fluorescent substance (Y, Gd). Concentration was changed to 0 to 5wt% in this combination. The relation of concentration, a relative luminance, and a reflection factor is collectively shown in Table 1.
[0032]

[Table 1]

表1

	添加混合濃度 (wt%)	相対輝度 (%)	反射率 (%)		
			at 450nm	at 530nm	at 600nm
実施例6	0.1	100	63	68	87
実施例7	0.2	97	53	59	82
実施例8	0.5	90	38	42	75
実施例9	1.0	81	32	34	66
実施例10	2.0	76	21	23	51
実施例11	5.0	61	10	11	40
比較例3	0	100	88	92	95

[0033] The reflection factor showed the with a wavelength [each] (600nm (red), 530nm (green), and 450nm (blue)) value. The concentration to which the concentration which can maintain 70% of the brightness to the example 3 of a comparison can maintain 90% of brightness [as opposed to the example 3 of 1wt% and a comparison in the concentration which can maintain 80% of the brightness to the example 3 of a comparison 2wt%] from this evaluation result is 0.5wt%. All the reflection factors in the blue field at the time of such concentration are 70% or less. Especially, at 5wt%, the average reflectance has obtained 20% or less. Moreover, even when other red fluorescent substances, O(P (Y, Gd), V)4:Eu, or Y2O3:Eu is used, the concentration which can maintain 80% of relative luminances is 1wt%, and it turns out that it has a similar property.

[0034] The concentration was optimized about the cobalt-green system material (ZnO/TiO2/NiO/CoO) which carries out addition mixture and which has absorption strong against a red field as it is blue in the examples 12-17 and the example 4 of a comparison, next the green fluorescent substance layer. The median particle diameter of an outdoor daylight absorber prepared 50nm or less (10 to 30nm) which becomes about 1 of the vacuum ultraviolet radiation (147nm and 172nm) of short wavelength / four waves from 200nm which is excitation light. Here, Zn2SiO4:Mn was used for the green fluorescent substance. The result to which concentration was changed to 0 to 5wt% is collectively shown in Table 2 in this combination.

[0035]

[Table 2]

表2

	添加混合濃度 (wt%)	相対輝度 (%)	反射率 (%)		
			at 450nm	at 530nm	at 600nm
実施例12	0.1	99	87	92	87
実施例13	0.2	95	80	89	80
実施例14	0.5	91	70	85	73
実施例15	1.0	82	61	78	62
実施例16	2.0	74	49	71	51
実施例17	5.0	60	35	55	34
比較例4	0	100	92	95	95

[0036] The concentration to which the concentration which can maintain 70% of the brightness to the example 4 of a comparison can maintain 90% of brightness [as opposed to the example 3 of 1wt% and a comparison in the concentration which can maintain 80% of the brightness to the example 4 of a comparison 2wt%] from this result is 0.5wt%. All the reflection factors in the blue field at the time of such concentration are 70% or less. Especially, at 5wt%, the average reflectance has obtained 40% or less. Moreover, even when other fluorescent substances and BaAl12O19:Mn were used, the concentration which maintains 80% of relative luminances was 1wt%.

[0037] The concentration was optimized about the cobalt blue system (CoO / aluminum2O3) which carries out addition mixture and which has absorption strong against a red field as it is green in the examples 18-23 and the example 5 of a comparison, next the blue fluorescent substance layer. The median particle diameter of an outdoor daylight absorber prepared 50nm or less (10 to 30nm) which becomes about 1 of the vacuum ultraviolet radiation (147nm and 172nm) of short wavelength / four waves from 200nm which is excitation light. Here, BaMgAl10O14:Eu was used for the blue fluorescent substance. The result to which concentration was changed to 0 to 5wt% is collectively shown in Table 3 in this combination.
[0038]
[Table 3]

表3

	添加混合濃度 (wt%)	相対輝度 (%)	反射率 (%)		
			at 450nm	at 530nm	at 600nm
実施例18	0.1	100	96	86	80
実施例19	0.2	96	95	84	76
実施例20	0.5	90	93	80	68
実施例21	1.0	80	92	73	58
実施例22	2.0	71	87	62	48
実施例23	5.0	50	78	44	30
比較例5	0	100	96	97	97

[0039] The concentration to which the concentration which can maintain 70% of the brightness to the example 5 of a comparison can maintain 90% of brightness [as opposed to the example 3 of 1wt% and a comparison in the concentration which can maintain 80% of the brightness to the example 4 of a comparison 2wt%] from this result is 0.5wt%. All the reflection factors in the red field at the time of such concentration are 70% or less. Especially, at 5wt%, the average reflectance has obtained 50% or less. Moreover, even when other fluorescent substances and Y(P, V) O4 were used, the concentration which maintains 80% of relative luminances was 1wt%.
[0040] If the evaluation result of the above examples 6-23 and the examples 3-5 of a comparison is collected, it is required to make concentration smaller than 0.5wt% for the brightness property to be almost the same even if it uses which charge of an outdoor daylight absorber, and to maintain 70% of relative luminances for maintaining 90% of relative luminances for concentration 1wt%, for maintaining 80% of relative luminances for concentration 2wt%. Moreover, it turns out that a reflection factor is small made by increasing concentration. This result showed that it was not concerned with an outdoor daylight absorption material kind and its fluorescent substance kind to combine, but the relation between brightness and its mixed concentration was very well in agreement. This is data very useful when actually applying the fluorescent substance layer of outdoor daylight absorber entering to the display panel of a plasma display. Moreover, it is thought that the ground for having acquired such a similar property is based on the absorption property being similar in the vacuum-ultraviolet region of the charge of an outdoor daylight absorber. It is thought that the relation between this brightness and concentration is applicable to other charges of an outdoor daylight absorber.
[0041] In the 24 or more-example example, comparative evaluation of each outdoor daylight absorber was carried out to red, green, and the blue fluorescent substance layer about the case where addition mixture of the same concentration is carried out, on the same substrate. Here, each fluorescent substance layer which carried out addition mixture of the concentration of an outdoor daylight absorber different for every luminescent color is formed on a tooth-back substrate. The case where it applies to the display PAL of a plasma display is explained.
[0042] The actually used material system the iron-oxide system material (Fe2O3) which has absorption strong against blue and a green field in a red fluorescent substance layer like before The cobalt-green system material (ZnO/TiO2/NiO/CoO) which has absorption strong against blue and a red field in a green fluorescent substance layer by the cobalt blue system (CoO / aluminum2O3) which has absorption strong against green and a red field in a blue fluorescent substance layer Each median particle diameter prepared the particle 50nm or less (10 to 30nm) which becomes about 1 of the vacuum ultraviolet radiation (147nm and 172nm) of short wavelength / four waves from 200nm which is excitation light. Moreover, a red fluorescent

substance is BO(Y, Gd)3:Eu, a green fluorescent substance is Zn2SiO4:Mn, and the blue fluorescent substance of each used fluorescent substance kind is BaMgAl10O14::Eu. The mixed concentration of the outdoor daylight absorber applied by this example is [in a red fluorescent substance layer] 0.5wt% 0.5wt% in a green fluorescent substance layer 0.1wt% in a blue fluorescent substance layer. The procedure of formation of a fluorescent substance layer and display-panel production was performed according to the example 1 and the conventional process. The cell pitch of the size of the display panel used for this example is 165micromx495micrometer in an equivalent (1024x768) for number XGA of 25 types and pixels.
[0043] in order to produce the fluorescent substance layer which does not mix the charge of an outdoor daylight absorber as the example 6 of a comparison, next an example of a comparison of an example 24 -- the conventional fluorescent substance paste -- preparing -- the same procedure as an example 24 -- a fluorescent substance layer -- production (it forms in 2 steps similarly) -- carrying out -- further -- the display panel of the plasma display of 25 type XGA was produced
[0044] Next, display-panel evaluation of an example 24 was performed on the basis of the display-panel property of the example 6 of a comparison. The display panel of an example 24 of the brightness of a display panel was 90% to the display panel of the example 6 of a comparison. Next, outdoor daylight reflex of a display panel was compared. It has checked that the reflection factor of a display panel was also lower than the example 6 of a comparison.
[0045] each fluorescent substance kind used for the 25th example -- a red fluorescent substance -- O(P (Y, Gd), V)4:Eu it is -- a green fluorescent substance is Zn2SiO4:Mn, and the case where a blue fluorescent substance was BaMgAl10O14:Eu was examined The mixed concentration of the outdoor daylight absorber applied by this example is [in a red fluorescent substance layer] 1wt% 1wt% in a green fluorescent substance layer 0.2wt% in a blue fluorescent substance layer. The procedure of formation of a fluorescent substance layer and display-panel production was performed according to the example 24.
[0046] the paste using the same fluorescent substance kind as an example 25 in order to produce the fluorescent substance layer which does not mix the charge of an outdoor daylight absorber as the example 7 of a comparison, next an example of a comparison of the above-mentioned example 24 -- preparing -- the same procedure as an example 24 -- a fluorescent substance layer -- production (it forms in 2 steps similarly) -- carrying out -- further -- the display panel of the plasma display of 25 type XGA was produced
[0047] Display display evaluation of an example 24 was performed on the basis of the display-panel property of this example 7 of a comparison. The relative luminance of the display panel of an example 25 of panel brightness was 85% to the display panel of the example 7 of a comparison. Furthermore, it has checked that the reflection factor of the display panel of an example 25 was lower than the value of the example 7 of a comparison, and the example 24.
[0048] In example 26 this example, addition mixture of the outdoor daylight absorber was carried out only at the fluorescent substance layer of red and blue. The result examined about the display panel of a plasma display is explained.
[0049] The actual configuration of a fluorescent substance layer does not add the charge of an outdoor daylight absorber for the iron-oxide system material (Fe2O3) which has absorption strong against blue and a green field in a red fluorescent substance layer in a green fluorescent substance layer. It consists of each fluorescent substance layer which added the cobalt blue system (CoO / aluminum2O3) which has absorption strong against green and a red field in a blue fluorescent substance layer. Moreover, the median particle diameter of each outdoor daylight absorber used the particle 50nm or less (10 to 30nm) which becomes about 1 of the vacuum ultraviolet radiation (147nm and 172nm) of short wavelength / four waves from 200nm which is excitation light. Moreover, a red fluorescent substance is BO(Y, Gd)3:Eu, and a green fluorescent substance each used fluorescent substance kind It is BaAl12O19:Mn and a blue fluorescent substance is BaMgAl10O14:Eu. The mixed concentration of the outdoor daylight absorber applied by this example is 0.9wt% 0.2wt% in a red fluorescent substance layer in a blue fluorescent substance layer. The procedure of formation of a fluorescent substance layer and display-panel production was performed according to the example 1 and the conventional process. The cell pitch of the size is 0.40mmx1.10mm in an equivalent (640x480) for number VGA of 40 types and pixels.
[0050] As the example 8 of a comparison, next an example of a comparison of the above-mentioned example 26, the charge of an outdoor daylight absorber was mixed in no fluorescent substance layers, but the display panel of the plasma display of 40 type VGA was produced. The fluorescent substance kind was made into the same combination as an example 26.
[0051] Next, display-panel evaluation of an example 26 was performed on the basis of the display-panel property of the example 8 of a comparison. The display panel of an example 26 of the brightness of a display panel was 95% to the display panel of the example 8 of a comparison.

Next, outdoor daylight reflex of a display panel was compared. It has checked that the reflection factor of a display panel was also lower than the example 8 of a comparison. Moreover, it checked that contrast was improvable with a comparison of a contrast property from the conventional display panel in the display panel which added the outdoor daylight absorber only in two sorts of fluorescent substance layers.

[0052] Example 27 this example examined the display panel of the plasma display of 25 type XGA which carried out addition mixture of the outdoor daylight absorber only to the red fluorescent substance layer.

[0053] In a green fluorescent substance layer and a blue fluorescent substance layer, the charge of an outdoor daylight absorber was not added for the iron-oxide system material ($Fe2O3$) which has absorption strong against blue and a green field in a red fluorescent substance layer in fact, but each fluorescent substance layer was formed. moreover, each used fluorescent substance kind -- a red fluorescent substance -- O(P (Y, Gd), V)4:Eu -- it is -- green fluorescent substance BaAl12O19:Mn it is -- a blue fluorescent substance is BaMgAl10O14:Eu The mixed concentration of the outdoor daylight absorber of the red fluorescent substance layer applied by this example is 2wt%. The procedure of formation of a fluorescent substance layer and display-panel production was performed according to the example 1 and the conventional process.

[0054] The fluorescent substance kind was made into the same combination as an example 27 as an example of a comparison of the above-mentioned example 27 at the 9th example of a comparison, and the display panel of the plasma display of 25 type XGA which mixes the charge of an outdoor daylight absorber in no fluorescent substance layers was produced.

[0055] Display-panel evaluation of an example 27 was performed on the basis of the display-panel property of this example 9 of a comparison. The display panel of an example 27 of the brightness of a display panel was 90% to the display panel of the example 9 of a comparison. In the display-panel property, the reflection factor was also still low than the example 9 of a comparison, and it checked having also improved contrast.

[0056] This result, Adding an outdoor daylight absorber in a part of fluorescent substance layer also checked that the contrast of the display panel of the plasma display of 25 type XGA was improvable from the conventional display panel.

[0057] When the result of the above examples 24-27 and the examples 6-9 of a comparison was collected, it was independent in the addition concentration of the charge of an outdoor daylight absorber mixed to red, green, and a blue fluorescent substance layer, and that it can change easily found the reflection factor by choosing any value, maintaining display-panel brightness on fixed level mostly. Moreover, it has checked that necessarily added the charge of an outdoor daylight absorber in no fluorescent substance layers, but ** also had enough effects in a reduction of a reflection factor. In the display panel of the plasma display of 25 type XGA which carried out the operation study here, contrast has been improved from the conventional display panel. The improvement is understood that it is more remarkable than the case of 40 type display panel, and it is more effective that this invention applies to a highly minute display panel.

[0058] In the above example, the structure of an outdoor daylight absorber entering fluorescent substance layer where a reduction of a real proof and photogenesis brightness can be suppressed for the relation between brightness and a reflection factor on a certain fixed level, and a reflection factor can acquire an effective value, and the inclusion concentration of an outdoor daylight absorber were found out, and the application examination was performed to the display panel of an actual plasma display. The fluorescent screen for a contrast improvement of this invention cannot be caught by the combination of the fluorescent substance kind shown in the example, and the charge of an outdoor daylight absorber, but it can be used together with the method [improve / contrast] for preparing the conventional dimming VCF in the front face of display-panel glass etc. while it is applicable to various material combination, and it can apply to the display which makes vacuum ultraviolet radiation the source of excitation, especially a plasma display.

[0059] AC type and DC type are in this plasma display, and these display panels are included in it with the drive circuit etc. Moreover, a reflected type and a penetrated type are shown in these display panels.

[0060]

[Effect of the Invention] according to this invention, practicality is high -- high -- a contrast plasma display is realizable

[Translation done.]

CLAIMS

[Claim(s)]

[Claim 1] The fluorescent substance layer characterized by including the fluorescent substance grain which emits the light by excitation of ultraviolet rays with a wavelength of 200nm or less, and the material which has an optical absorption to wavelength fields other than the wavelength of this light.

[Claim 2] It is the fluorescent substance layer characterized by being a mixture with the material into which the above-mentioned fluorescent substance layer has the above-mentioned fluorescent substance grain and the above-mentioned optical absorption in a claim 1.

[Claim 3] It is the fluorescent substance layer characterized by being the laminating field which has in part the layer which consists of a mixture with the material into which the above-mentioned fluorescent substance layer has the above-mentioned fluorescent substance grain and the above-mentioned optical absorption in a claim 1.

[Claim 4] the claim 2 or 3 -- setting -- the above -- a mixture -- the content of a material which has the inner above-mentioned optical absorption -- the above -- a mixture -- the fluorescent substance layer characterized by being less than [5wt%] to the inner above-mentioned fluorescent substance grain

[Claim 5] It is the fluorescent substance layer characterized by the above-mentioned content being smaller than 1wt% in a claim 4.

[Claim 6] The median particle diameter of a material which has the above-mentioned optical absorption in the claim 1 or any 1 term of 5 is a fluorescent substance layer characterized by being 200nm or less.

[Claim 7] The median particle diameter of a material which has the above-mentioned optical absorption in a claim 6 is a fluorescent substance layer characterized by being 100nm or less.

[Claim 8] The median particle diameter of a material which has the above-mentioned optical absorption in a claim 7 is a fluorescent substance layer characterized by being 50nm or less.

[Claim 9] The material which has the above-mentioned optical absorption in the claim 1 or any 1 term of 8 is a fluorescent substance layer which is a system containing Fe_2O_3 and is characterized by having an optical absorption to blue and a green wavelength field.

[Claim 10] The material which has the above-mentioned optical absorption in the claim 1 or any 1 term of 8 is a fluorescent substance layer which is a system containing $ZnO/TiO_2/NiO/CoO$ and is characterized by having an optical absorption to red and a blue wavelength field.

[Claim 11] The material which has the above-mentioned optical absorption in the claim 1 or any 1 term of 8 is a fluorescent substance layer which is a system containing CoO / aluminum2O3, and is characterized by having an optical absorption to red and a green wavelength field.

[Claim 12] Display characterized by having the source of excitation which generates the ultraviolet rays which contain the wavelength of 200nm or less for exciting the fluorescent substance layer and this fluorescent substance layer of a publication in the claim 1 or any 1 term of 11.

[Claim 13] The red from whom it has this drive circuit that carries out a display-panel drive with a display panel, and the above-mentioned display panel is constituted from a fluorescent substance layer of a publication by the claim 1 or any 1 term of 11, Display characterized by having gas which generates the ultraviolet rays which electric discharge arises from the electrode and the above-mentioned drive circuit of blue and a green fluorescent substance layer, and a couple with the applied voltage to the electrode of the above-mentioned couple, and contain the wavelength of 200nm or less, and for the above-mentioned ultraviolet rays exciting the above-mentioned red, blue, and a green fluorescent substance layer, and emitting the light.

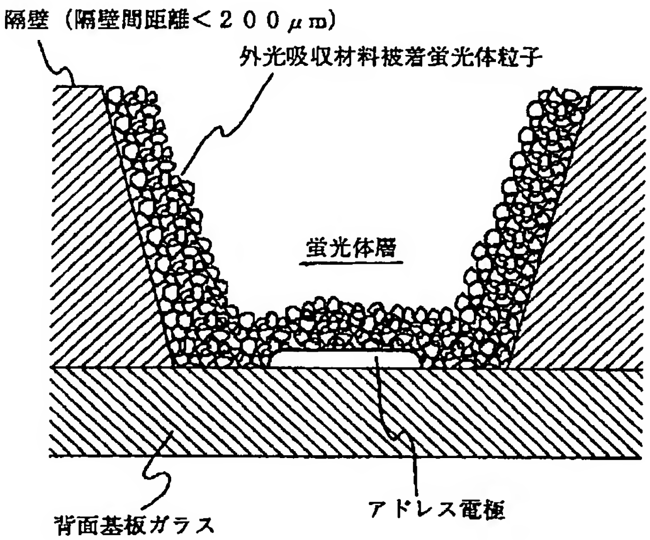
[Claim 14] It is the display which the above-mentioned display panel has the septum for specifying the field of the above-mentioned electric discharge in the claim 13, and is characterized

by the spacing of this septum being 200 micrometers or less.

[Translation done.]

Drawing selection [Representative drawing]

図１



[Translation done.]

Drawing selection Drawing 2

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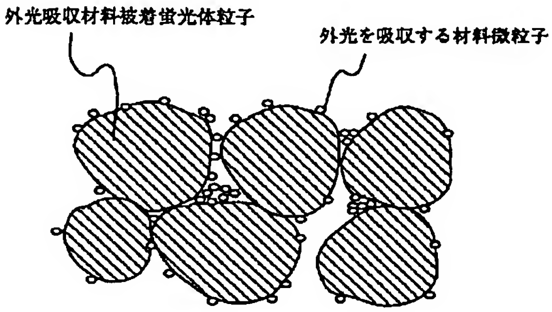

[Translation done.]

Drawing selection Drawing 3

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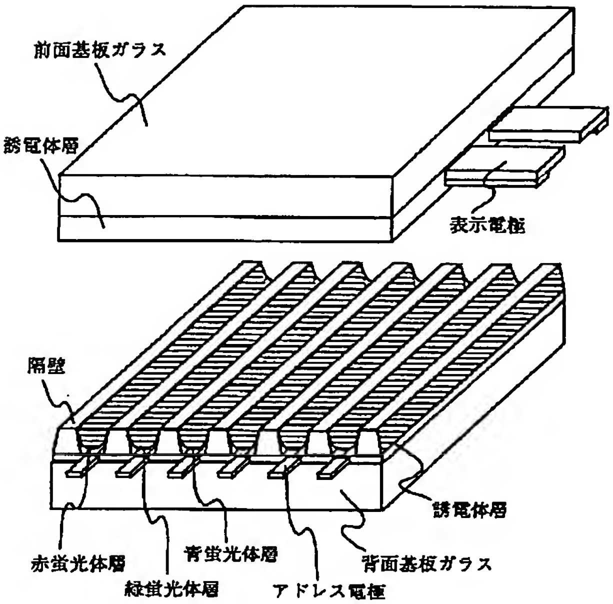

[Translation done.]

Drawing selection Drawing 4

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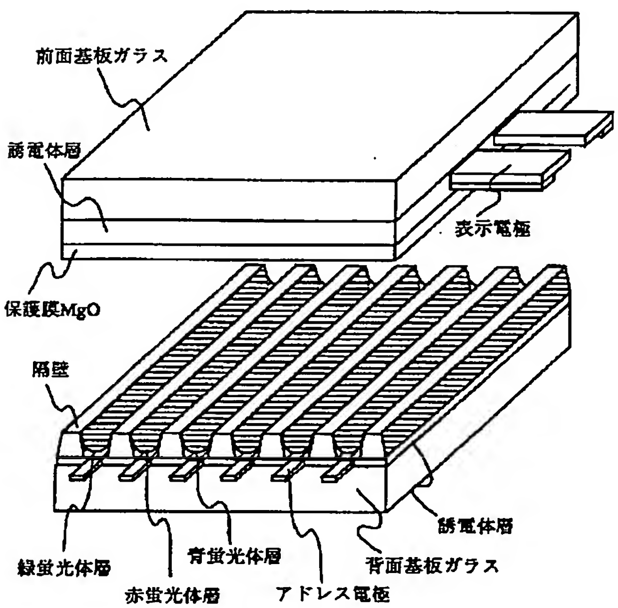
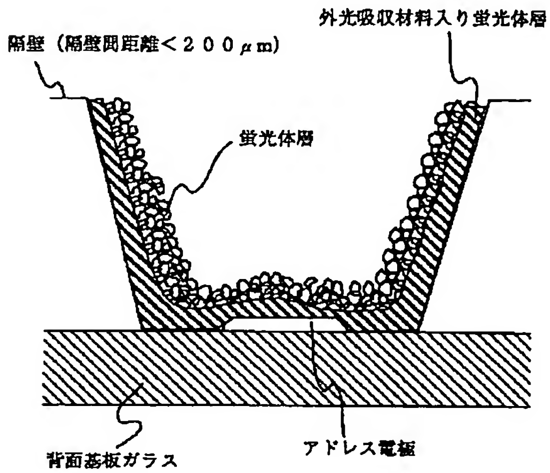


[Translation done.]

Drawing selection Drawing 5

図5



[Translation done.]